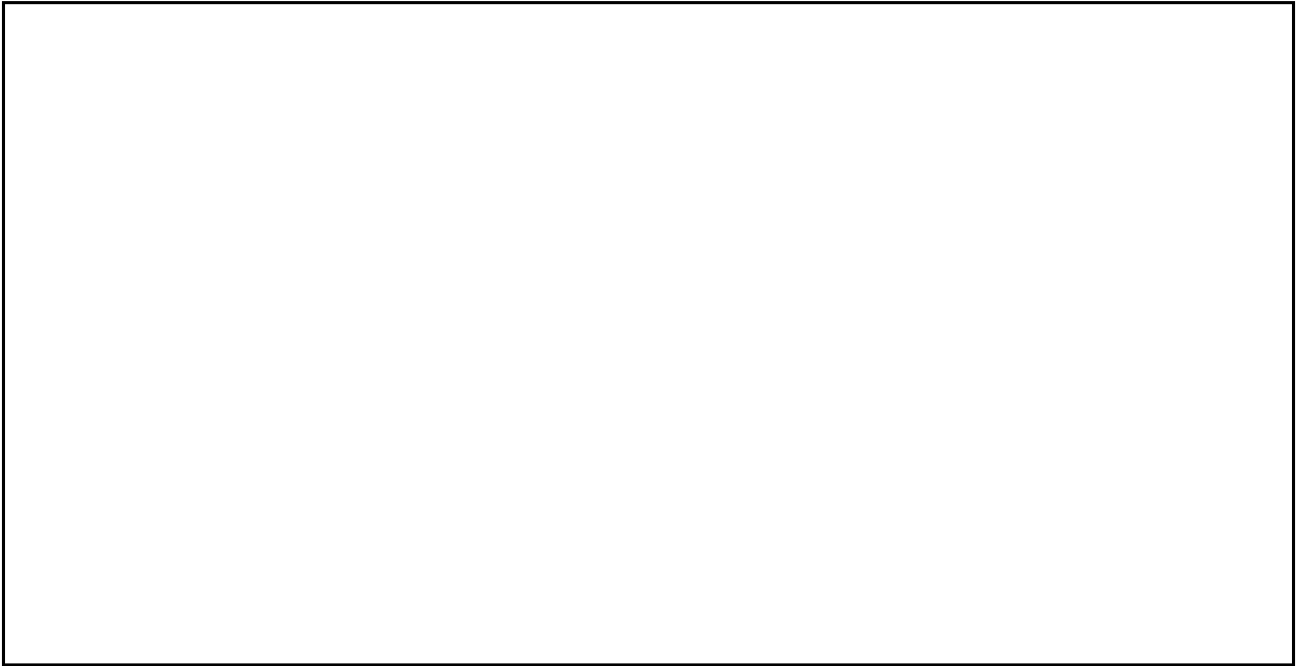


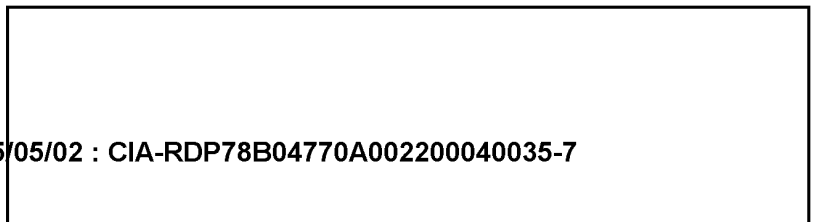
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IMAGERY INTERPRETATION RESEARCH PROGRAM

FINAL REPORT
HUMAN FACTORS EVALUATION
1540 SPLIT-FORMAT LIGHT TABLE

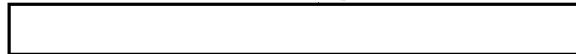
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This report is in partial fulfillment
of Task No. 3 of



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1.0 INTRODUCTION

STAT A preliminary report, DK-425, was previously submitted summarizing the results and recommendations from a human factors evaluation of the [] MIM-6 Split-Format 1540 Light Table performed at the Sponsor's facility on 7 May 1969. The present report documents the procedure followed and presents the details of the results. For clarity, the objective and approach of the evaluation from the previous document are repeated in sections 2.0, Objective, and 3.0, Approach. Section 4.0, Results, has become Section 5.0, Summary and Recommendations, in this document.

2.0 OBJECTIVE

STAT The objective of the human factors evaluation was to determine if the subject light table prototype model meets the human factor requirements imposed by the design objective, and general human engineering requirements as given in the Human Engineering Design Guide for Image Interpretation Equipment, [] February 1969.

3.0 APPROACH

STAT A human factors checklist was compiled from applicable sections of the Design Guide with particular attention given to anthropometric considerations. The evaluation consisted of evaluating light table features against the human factors checklist. The evaluation was made of a prototype model 1540 table with [] Zoom 240 Microstereoscope fitted with mono-stereo tilting eyepieces and advanced stereo rhomboid (optical axis separation of 1.6 to 9.5 inches).

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Several light table parameters - illumination level, color and uniformity of illumination, flicker, noise, and vibration - require sophisticated electronic instrumentation for checkout. These tasks are to be accomplished by Sponsor Test and Evaluation Group. The present evaluation included those parameters listed in Section 4.0, Results. The completed checklist is shown in Appendix A.

4.0 RESULTS

4.1 GENERAL CONFIGURATION

The expected operator population includes 90% of the U.S. adult population under 60 years of age. This is interpreted to include the upper 95% of the female population and the lower 95% of the male population. Table 1 gives the relevant dimensions estimated for representative members of this population.

TABLE 1: CRITICAL OPERATOR DIMENSIONS (Inches)¹

	SITTING ² EYE HEIGHT	KNEE ³ HEIGHT	POPLITEAL ^{3,4} HEIGHT	BUTTOCK- KNEE CLEARANCE	THIGH CLEARANCE
5th PERCENTILE FEMALE	26.5	19.5	15.5	20.5	4.0
50th PERCENTILE FEMALE	29.0	21.0	17.5	22.5	5.5
5th PERCENTILE MALE	28.3	20.5	16.5	21.5	4.5
50th PERCENTILE MALE	30.5	22.5	18.5	23.5	6.0
95th PERCENTILE MALE	32.0	24.5	20.5	25.5	7.0
<p>1 Weight, Weight, and Selected Body Dimensions of Adults, 1960-1962, U.S. Dept. of Health, Education and Welfare, Pub. No. 1000, U.S. Government Printing Office, Washington, D.C., 1965.</p> <p>2 Measured from seat reference point.</p> <p>3 Includes allowance for shoes (1 inch for men, 1.5 inch for women).</p> <p>4 Distance from bottom of foot to the sitting surface.</p>					

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Eye-piece Height

The thickness of the light table is critical in determining whether the combined equipment (microstereoscope, rhomboids and table) can be used by the smaller male and female interpreters. Eye-piece height measurements were taken on the 1540 light table equipped with a 240 microstereoscope with mono-stereo tilting eyepieces and advanced stereo rhomboid attachment. The distance from table top to the center of the eyepiece with the rhomboid at working distance from the table top is 10.5 inches; the table is 5.5 inches thick. Thus the distance from table bottom to eyepiece is 16.0 inches. Standard adjustable chairs can be varied in height from 15 to 19 inches.

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A small operator (5th percentile female) has a sitting eye height of 26.5 inches and when seated in a 15-inch-high chair has a working eye height of 41.5 inches. At the table's lowest elevation working eye height is 41.0 inches. This can accommodate the small operator. Average thigh clearance for the 5th percentile female is 4 inches and when seated on a 15-inch-high chair will have 6.5 inches clearance to the top of the kneewell. The conclusion is that the 1540 light table in the configuration tested will accommodate the seated 5th percentile female operator.

A 95th percentile male (seated eye height 32.0 inches) seated in a 19.0-inch-high chair would require an eyepiece height of 51.0 inches. Working eyepiece height is adjustable up to 57.5 inches. Thus, he can be accommodated. The large operator has an average thigh clearance of 7.0 inches. With the eyepiece at 51.0 inches and if seated on a 19.0-inch-high chair, the large operator will have 9 inches clearance to the top of the kneewell. The conclusion is that the 1540 light table in the configuration tested will accommodate the seated 95th percentile male operator.

When the 1540 Split Format Light Table is used with the Zoom 240 microstereoscope with standard eyepieces and advanced rhomboids, Model II

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attached, the working distance of the eyepieces above the table top is 14.9 inches. This figure was determined during a study to determine the most suitable eye height and angle of elevation for the eyepieces of a microstereoscope (DK-342). For the 5th percentile female operator seated on a 15.0-inch-high chair, working eye height is 41.5 inches. Table thickness is 5.5 inches; the distance from table bottom to eyepiece is 20.4 inches. Assuming a 4-inch average thigh thickness, the 5th percentile female operator has 2.1 inches clearance to the top of the kneewell. For the seated 95th percentile male operator seated on a 19.0-inch-high chair, the eye height is 51.0 inches. The distance from table bottom to eyepiece is 20.4 inches. Assuming an average thigh thickness of 7.0 inches, the 95th percentile male operator has 4.6 inches clearance to the top of the kneewell. The conclusion is that 5th percentile female and 95th percentile male operators can be satisfactorily accommodated by the 1540 Split Format Light Table when fitted with a Zoom 240 Microstereoscope and Advanced Rhomboid Model II attachment.

The standing eye height of the 95th percentile male is 69.0 inches (H.E. Design Guide for Image Interpretation Equipment, Feb. 1969). With Advanced Rhomboid Model II attachment maximum table elevation with microstereoscope at a working height is 61.9 inches. The operator is required to slump 7.1 inches. This is acceptable because an operator can slump to use an eyepiece that is too low but cannot comfortably stretch to use one that is too high.

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Kneewell Dimensions

With the 1540 Split Format Light Table at lowest elevation, the kneewell dimensions are 30.0 inches wide, 14.5 inches deep, and 25.0 inches high. Height and width dimensions are adequate to accommodate the largest operator (95th percentile male) when the table is at a working height. The kneewell depth is the critical dimension. Fifteen inches is given as adequate by the Design Guide (Page 4-29) for a typical control console. The 1540 Light Table

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kneewell is 14.5 inches deep. However, the eyepoint of the microstereoscope in working position is located at the near edge of the table. The author approximately a 98th percentile male, had no difficulty in sitting at the table in working position. Although the 14.5-inch kneewell depth is 0.5 inch less than required for a typical console, it seems to present no problem in accommodating the large operator.

4.2 FILM LOADING AND UNLOADING

Film loading and unloading operations are possible at all height elevations of the table. Access around the loading and unloading mechanism is adequate. Spool width adjustments are in discrete steps which are acceptable. Two-handed manipulation of the film spool is not possible, as the spool "key" must be engaged with one hand as the spool is supported and positioned by the other. No positioning guides are provided. Blind positioning the spools is not normally required during loading and unloading operations.

Instruction decals picturing loading operations would be valuable in assisting the operator during loading operations. They should be engraved on panels and be placed in close proximity to the film spools when they are in their operating position.

4.3 MOTORIZED FILM TRANSPORT

Film transport rate was not measured but was observed to be variable from quite slow for visual scanning to quite fast for film rewind. Accurate frame location and positioning is possible following familiarization with the sensitivity of the motorized system.

Automatic film tension is provided and is adequate at all film movement speeds observed. No film backlash was observed at any speed or during rapid reversal of film travel direction.

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Direction-Rate controls are accessible from normal operator viewing positions.

No electrostatic charge effects were observed during film transport operations.

Manual film transport is possible. Auxiliary crank handles are provided should a power failure occur. They are adequate only as an emergency provision.

4.4 MOTORIZED MICROSTEREOSCOPE CARRIAGE

Microscope positioning is possible manually and also by a motorized system. A joystick controls the carriage movement. Although the movement rate is slow it appears adequate. Gross positioning movements can be accomplished manually with final adjustments made using the motor drive. Only a short familiarization period is required to become adequately proficient.

The microscope and mount can be quickly lifted to its highest position above the table top manually, but must be returned to a working position using a crank for gross movement and knobs for fine adjustments. No stop is provided which will guard against the microscope's lenses striking the emulsion as the microscope is positioned for viewing. Provisions for this feature should be made.

With man power off the microscope carriage is not secure. It is free to move in X and Y directions. Possible damage to the scope or its mount may occur as a result of the table being moved. A locking mechanism should be provided.

4.5 MOTORIZED TABLE HEIGHT ELEVATION

The motorized height elevation system is quite slow and table movement is not continuously stable. During both raising and lowering operations the

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table oscillates. A manual elevating crank is provided but because of the excessive effort required is relatively ineffective. Adjustment range is adequate.

It is recommended that the elevating system be examined for possible ways to stabilize the table during raising and lowering operations.

4.6 LABELS AND SECONDARY DISPLAYS

All controls and secondary displays are labeled but some do not follow the recommendation in the Design Guide.

The panel which contains controls for direction of film spool movement is labeled incorrectly.

Labels "Front," "Rear," and "Lower" appear below the toggle switches to which they refer. Individual labels should be positioned above the control to which they refer.

A panel containing film speed, motor power, and light intensity controls is labeled as recommended by the Design Guide with the exception of the motor power toggle switch "Off" and "On" labels. Presently "On" is to the left and "Off" to the right of the switch. The "On" label should appear above the toggle switch and "Off" below it. Direction of the throw for the toggle switch must be changed to follow the relocation of the labels.

Above the control panel is a stick-on label which reads "Do Not Reverse With Power On." This label should be engraved similarly to the other labels appearing on the panel, with the word "Caution" preceding the statement.

Red indicator lights are provided for the main power switch, film drive power switch and temperature indicator switch but not for the carriage

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power switch. An indicator light should be provided for the carriage power switch, and all light indicators should be white with the exception of the temperature indicator which should remain red because it alerts the operator to an out-of-tolerance temperature condition.

4.7 CONTROLS

For rapid motorized film movement, such as rewind, a film speed knob is provided. Fairly good control of film speed can be maintained with practice.

For control of slow film movement as required for scanning, a crank is provided. When the crank is turned it generates a signal which unbalances the drive motors and moves the film. Crank rotation must reach a threshold rate before film movement begins. Intermediate and high film speeds are easy to achieve; slow movement is not easy to control. The crank overrides the knob control for film movement, and when the relative amount of film on each roll changes the knob must be set to a new "null" position so that control of film movement is possible with the crank.

The film speed and light intensity controls are round knobs alike in size and shape. Since they are located in close proximity to each other, they may be confused. Shape coding of the knobs, e.g., one round and one triangular in shape, would eliminate any possible confusion of the two knobs.

Carriage movement in X, Y, and combination X-Y directions is controlled by a small joystick. The joystick control is located too close to the carriage lock release button, which consequently interferes with its operation. It should be relocated either to the other side of the microscope mount or further away from the carriage release button, so as to allow adequate access to the switch.

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5.0 SUMMARY AND RECOMMENDATIONS

The content of this section is the same as Section 4.0, Results, from the previously submitted preliminary report, DK-425.

5.1 GENERAL CONFIGURATION

Eyeiece Height. Adequate eyeiece height adjustments are possible which accommodate a 5th percentile female and a 95th percentile male. The light table will accommodate operators falling within this range.

Kneewell Dimensions. The kneewell depth measures 14.5 inches, which is 0.5 inch less than required for a typical control console. However, the 14.5 inches appear adequate in this particular case.

5.2 FILM LOADING AND UNLOADING

Loading and unloading of roll film is possible at all elevations of the light table. Access is adequate and spool width adjustment is in discrete steps. Two-handed manipulation of the film spool during loading is not possible.

5.3 MOTORIZED FILM TRANSPORT

Film tension is automatic and remains adequate at all film movement speeds. Direction-rate controls are accessible from normal operator viewing position. Emergency film crank handles are provided but are inadequate for normal operational use because of their small size.

5.4 MOTORIZED MICROSTEREOSCOPE CARRIAGE

Microscope height adjustment range is adequate. However, no provision is made to prevent the microscope rhomboid from striking the film or table

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formats when lowered. Damage to the rhomboid, film or table surface could result. It is recommended that provisions be made which would eliminate any possibility of damage resulting from microstereoscope height adjustments.

No locking mechanism is provided for the microscope carriage when power is off. The microscope with rhomboid attachment could be damaged should the unit be slammed against the carriage travel stops as a result of negligence or transportation of the table.

5.5 MOTORIZED TABLE HEIGHT ELEVATION

Motorized height adjustment is slow and unstable. The table oscillates noticeably when being raised and lowered. The spring-loaded toggle switch control is appropriate for its function but must be operated from a standing position at higher table elevations. No change in position of the control switch is recommended. It is recommended that the elevating system be improved such that table oscillation is eliminated.

5.6 LABELS AND SECONDARY DISPLAYS

Labels "Front," "Rear," and "Lower" for toggle switches controlling direction of spool rotation appear below their respective switches. They should be positioned above their respective switches.

"On" and "Off" labels for the film motor power switch are placed to the left and right of the switch. The switch should be rotated clockwise 45 degrees so that the "On" position is up and the "Off" position is down, and labeled appropriately above and below the switch.

The stick-on label which reads "Do Not Reverse With Power ON" and appears directly above the motor direction controls should be engraved on a panel with a red border and read, "CAUTION, ..."

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Red indicator lights which accompany the main power switch and film drive power switch should be white. A white indicator light should also be provided for the microscope carriage power switch.

5.7 CONTROLS

The film speed control is adequate for moving film at both fast and slow speeds. A "Null" position can be found which keeps the film from moving. The "Null" position varies as a function of the relative amount of film on each spool.

The crank which controls slow film movement is difficult to control. Because a threshold rotation rate must be attained prior to film movement, adequate control is difficult. If a more stable control cannot be provided for this function, a training program will be required. The program will train the operator in the use of the motorized film transport system.

Film speed and light intensity control knobs are the same in size and shape. They should be shape-coded to prevent confusion between the two knobs.

The joystick which controls the motorized carriage X, Y, and X-Y movement is located too close to the carriage lock release button. It should be re-located so that adequate access is possible, possibly on the opposite side of the microscope mount.

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APPENDIX A

HUMAN ENGINEERING CHECKLIST

1540 LIGHT TABLE

The following pages are copies of the completed human engineering checklist used to evaluate the 1540 Light Table.

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HUMAN ENGINEERING CHECKLIST
1540 LIGHT TABLE

PARAMETER	RECOMMENDATION	COMMENTS
Illumination Level	<p>(1) Adjustable - Logarithmic control is preferred, linear control is acceptable. Color temperature change should be minimized.</p> <p>(2) Maximum level should be at least 1500 foot-Lamberts (2500 foot-Lamberts is preferred) plus compensation for maximum light loss of any optical instruments to be used. For interpreters over 60 years of age maximum value should be increased by 1/3.</p> <p>(3) Minimum level should be less than 75 foot-Lamberts. If low level ambient illumination is used minimum table luminance should not exceed ambient levels by more than a factor of 3.</p>	No measurement taken.
Color of Illumination	<p>(1) Broad-band white illumination</p> <p>(2) Minimize radiation below 380 nanometers and above 750 nanometers.</p> <p>- American Medical Association limit for 7 hr/day exposure to ultra-violet radiation (below 380 nanometers) is 0.5 microwatts/cm²</p> <p>- Comfort limit above 750 nanometers is 0.025 watts/cm² - less is preferred.</p>	<p>Color change noticable.</p> <p>No measurement taken.</p> <p>No measurement taken.</p>
Uniformity of Illumination	<p>(1) Brightness gradients should not be perceptible.</p> <p>(2) Maximum linear gradients of from 33% to 60% from center to edge have been suggested but no known valid specifications are available.</p>	<p>No measurement taken.</p> <p>Noticable gradients both formats</p>
Flicker	<p>(1) Flicker frequency should exceed 80 cycles per second.</p> <p>(2) For low luminance (<100 ft-Lamberts) or small size (<20 degrees visual angle) fields, frequencies down to 60 cycles per second are acceptable.</p> <p>(3) Beat frequencies of multiple lamp sources must exceed the above levels.</p> <p>(4) Stroboscopic effect with moving imagery may be a problem; no data available.</p>	<p>Flicker perceptible at all illumination levels.</p> <p>No measurement taken.</p>
Surround Illumination	<p>OK (1) Provision must be made to shield or dim unused portions of the illuminated surface.</p> <p>? (2) Luminance of areas surrounding the viewed imagery should be approximately 20% to 90% of the apparent field luminance and must not exceed this level by more than a factor of three.</p> <p>OK (3) Shades or shields must not interfere with other uses of the table surface (e.g. writing, storage of magnifiers, scales, etc.).</p> <p>OK (4) Adjustment must be quick and convenient.</p> <p>OK (5) The use of specularly reflecting materials on visible table surfaces should be avoided.</p>	<p>Shields both formats</p> <p>Not measured</p> <p>No interference</p> <p>Yes</p> <p>None</p>

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HUMAN ENGINEERING CHECKLIST 1540 LIGHT TABLE

PARAMETER	RECOMMENDATION	COMMENTS
General Configuration	<p>(1) The light table surface and/or the eyepieces of optical instruments should be positioned within the recommended visual work areas for the individual interpreter.</p> <p>(2) Operating controls and manual work surfaces should be positioned within the recommended manual work areas for the individual interpreter.</p> <p>(3) Clearances and dimensions of the light table <u>with associated furniture</u> should conform to console recommendations as appropriate.</p>	<p>OK for seated operator. Advanced Rhomboid Mod II spans 15 inches. Yes</p> <p>OK. Sec. 4.4 Guide</p>
Height Adjustment	<p>(1) An adjustment range of 7 inches is recommended for seated operations and 14 inches for standing positions.</p> <p>(2) Additional adjustment may be necessary to accommodate height variation in eyepieces of optical instruments to be used.</p> <p>(3) Height adjustment control should be accessible from the viewing position. The interpreter should not have to support the table during the adjustment operation.</p>	<p>OK. Manual cranking system is too difficult to use.</p> <p>OK. Microscope adjustments accommodated</p> <p>Switch is difficult to reach by seated operator at highest elevations.</p>
Tilt Adjustment	<p>(1) A range of tilt adjustment from 0 degrees to 45 degrees is recommended; tilts up to 60 degrees can be used for unaided viewing with small tables (less than 10 inches in width).</p> <p>(2) Tilt adjustments must be compatible with eyepiece angles of optical instruments used.</p> <p>(3) Adjustment control should be accessible from the viewing position.</p>	N/A
Loading and Unloading	<p>(1) Loading/unloading operations should be possible at all height-tilt positions of the table.</p> <p>(2) Access around the loading/unloading mechanism must be sufficient to permit comfortable body positions. Where hand clearance is necessary 1 3/4 inches must be added to the maximum spool diameter.</p> <p>(3) Spool width adjustments in discrete steps is preferred, continuous adjustment is acceptable if flexibility is required.</p> <p>(4) Where possible, the spool mounting mechanism should permit two-handed manipulation of the spool.</p> <p>(5) Positioning guides are helpful to reduce the need for precise positioning by the interpreter.</p> <p>(6) Blind positioning of spools should be avoided. If convenient visibility cannot be provided, positioning guides are necessary.</p>	<p>OK</p> <p>OK</p> <p>OK discrete adjust only</p> <p>No. One-handed operation</p> <p>None</p> <p>Not required.</p>

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HUMAN ENGINEERING CHECKLIST 1540 LIGHT TABLE

Crank difficult to control. Training required.

PARAMETER	RECOMMENDATION	COMMENTS
Film Transport (Motorized)	<p>(1) Film transport rate for viewing should be adjustable to permit efficient frame location and positioning, frame advance, or continuous scan. The useful range varies from about 100 feet/minute to about 2 feet/minute. Film transport rate for rewind should be maximum consistent with engineering considerations to reduce unproductive interpreter time.</p> <p>(2) Automatic film tension control should be provided.</p> <p>(3) Direction and rate controls should be accessible from all interpreter viewing positions. The direction control should always move in the direction of desired film movement.</p> <p>(4) Backlash should be minimized; interlocks should protect against inadvertent high-speed reversal.</p> <p>(5) Grounding techniques should be employed to eliminate the accumulation of electrostatic charges.</p>	<p>Steady rate except at roll ends continual operation of speed control is required. Rate not measured.</p> <p>Yes. Tension good all conditions - automatic control Yes. OK</p> <p>None. Excellent. No interlocks. reversal not damaged.</p> <p>None observed.</p>
Film Transport (Manual)	<p>(1) Specific recommendations for manual film transport mechanisms are not available. Critical parameters include; size of crank, resistance, film displacement/crank revolution, and crank location and mounting angle.</p> <p>(2) Provisions should be made for maintaining proper film tension at all transport speeds.</p> <p>(3) Grounding techniques should be employed to eliminate the accumulation of electrostatic charges.</p>	<p>Adequate only for use in event of failure of motorized drive</p>
Labels and Secondary Displays	<p>(1) All controls and secondary displays must be appropriately labeled.</p> <p>(2) The following secondary displays can be helpful although none are essential:</p> <p>"power on" indicator table height scale table tilt angle scale table luminance level film drag adjustment scale film speed scale (motorized drive) film sprocket width scale frame counter</p>	<p>OK.</p> <p>Satisfactory.</p>

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HUMAN ENGINEERING CHECKLIST

1540 LIGHT TABLE

PARAMETER	RECOMMENDATION	COMMENTS																		
Controls	<p>(1) The following types of controls are recommended:</p> <table><thead><tr><th>Control</th><th>Recommended Type</th></tr></thead><tbody><tr><td>power</td><td>pushbutton/toggle switch</td></tr><tr><td>table height</td><td>handcrank manual</td></tr><tr><td>table tilt</td><td>handcrank/lever</td></tr><tr><td>luminance level</td><td>knob; pushbutton</td></tr><tr><td>film speed</td><td>handcrank; knob; pushbutton</td></tr><tr><td>film direction</td><td>toggle switch; pushbutton</td></tr><tr><td>shade or mask</td><td>lever</td></tr><tr><td>film transport</td><td>toggle switch</td></tr></tbody></table> <p>(2) Design, placement and arrangement of controls should conform to Human Engineering Standards.</p>	Control	Recommended Type	power	pushbutton/toggle switch	table height	handcrank manual	table tilt	handcrank/lever	luminance level	knob; pushbutton	film speed	handcrank; knob; pushbutton	film direction	toggle switch; pushbutton	shade or mask	lever	film transport	toggle switch	<p>OK</p> <p>Toggle for power</p> <p>OK</p> <p>Automatic</p> <p>OK</p> <p>OK</p> <p>OK</p>
Control	Recommended Type																			
power	pushbutton/toggle switch																			
table height	handcrank manual																			
table tilt	handcrank/lever																			
luminance level	knob; pushbutton																			
film speed	handcrank; knob; pushbutton																			
film direction	toggle switch; pushbutton																			
shade or mask	lever																			
film transport	toggle switch																			
Maintainability	<p>(1) Convenient access must be provided for lamp or fuse replacement and for blower lubrication if required.</p> <p>(2) Indicator lights if used should be replaceable from the front of the panel.</p> <p>(3) Electric circuit test points should be available at the following: power input, power switch, intensity control, lamp input. For motorized film transport, the following additional points should be available: speed control, direction control, motors. A circuit diagram should be provided (e.g. mounted inside an access panel).</p> <p>(4) Table surface materials must be selected to preclude damage by standard cleaning solvents. Caution labels should be displayed if special cleaning techniques are necessary.</p> <p>(5) Caution labels should be displayed when damage to table surface is possible from chipping or annotating operations.</p>	<p>Yes</p> <p>Yes</p> <p>Not determined</p> <p>No labels</p> <p>No labels</p>																		

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HUMAN ENGINEERING CHECKLIST

1540 LIGHT TABLE

PARAMETER	RECOMMENDATION	COMMENTS
Safety	<p>(1) All external, non-current-carrying metal parts must be electrically connected and grounded.</p> <p>(2) Provisions must be made to prevent personnel from coming into contact with circuits operating with an open circuit potential of 30 volts or more and a capability for delivering 2.5 peak milliamperes or more into a short circuit.</p> <p>(3) No exposed part shall exceed a surface temperature of 110°F.</p> <p>(4) Glass table surfaces must be capable of supporting maximum anticipated weights. Safety or "non-shatter" glass is recommended.</p> <p>(5) Tilt and height adjustment locking mechanisms shall be capable of sustaining maximum anticipated loads. Design shall preclude accidental release.</p> <p>(6) Special precautions to avoid breakage of metallic vapor lamps must be made.</p> <p>(7) Moving parts (e.g. ventilating fans, film belts or gears) must be enclosed.</p> <p>(8) Sharp edges or corners should be avoided. This is especially important for film spools.</p> <p>(9) Design shall preclude inadvertent blockage of ventilating air intakes.</p>	<p>? Motorized microscope carriage does not lock in any position when power is off. It is free to move about in X & Y.</p> <p>? ? ? ? Appears adequate N/A Yes - moving spools, etc. exposed. Yes ?</p>
Noise	<p>(1) Maximum equipment noise energy levels shall not exceed NC-40 levels in "quiet" rooms or NC-45 in typing or keypunch areas.</p> <p>(2) Energy levels concentrated in narrow bands (e.g. transformer hum, fan noise) shall be at least 10 decibels below the appropriate NC curve.</p> <p>(3) Measurements shall be referenced to the normal head position of the average interpreter.</p>	<p>Not measured. But all motors appear noisy - recommend measurement be taken to determine if there is a problem.</p>
Vibration	<p>(1) Mounting of moving equipment (e.g. ventilating fans) should provide maximum attenuation at frequencies above 5-10 Hertz.</p> <p>(2) Table mass and mounting stability should be sufficient to minimize externally induced vibration.</p>	<p>Not measured.</p> <p>Elevating mechanism not stable.</p>
Mounts for Optical Instrumentation	<p>(1) Design and positioning of mounts must permit convenient access for installation and removal of instrumentation and film.</p> <p>(2) Mounting devices shall be sufficiently rigid to preclude instrument misalignment by normal handling and operation.</p> <p>(3) Positioning adjustments in x and y, if provided, should require only one hand for operation. The direction of applied force should not be critical to avoid binding.</p> <p>(4) Height adjustment must be provided with stops to preclude accidental contact of the optical instruments with the table surface.</p>	<p>Yes OK OK None provided</p>
Manuals	<p>(1) Both operator and maintenance manuals should be provided.</p>	<p>None available at review.</p>

AN ENGINEERING CHECKLIST

1540 LIGHT TABLE

6.0 IMAGERY DISPLAY SYSTEM DESIGN

6.1 GENERAL CONFIGURATION

6.1.1 Requirements for general layout of the major scope components must include considerations of intended use (e.g., mounting height and range of positions when used with selected light tables).

6.1.2 When mounted, the eyepiece should be located at the interpreter's eye height. Although adjustments are best made in seat and/or table height, the scope design must be compatible with available table and seat adjustment ranges. Acceptable eye height must be maintained over all possible X and Y positions of the scope.

6.1.3 Eyepiece angle should be compatible with the normal, relaxed, line of sight. A tilt of 15 degrees from the horizontal is recommended. Deviations from the recommended angle, if necessary, should increase rather than reduce the angle from the horizontal.

6.1.4 Eye cups or eyepiece shields can be effective in reducing the effects of external glare sources. Such devices, however, should be designed for use by interpreters wearing spectacles.

6.1.5 Headrests may be desirable when accurate eye positioning is required. They must be adjustable to accommodate the appropriate range of user's head dimensions. Installation, adjustment and removal of headrest must be easy and convenient. It must be mounted so as not to interfere with normal control operation. Mounting arrangement and stability must preclude undesirable movement of the scope cups.

6.1.6 The use of specularly reflecting materials (e.g., chrome knobs, polished shafts) on external surfaces should be avoided.

6.1.7 The light table surface and/or the eyepieces of optical instruments should be positioned within the recommended visual work areas for the individual interpreter.

6.1.8 Operating controls and manual work surfaces should be positioned within the recommended manual work areas for the individual interpreter.

6.1.9 Clearances and dimensions of the light table with associated furniture should conform to console recommendations as appropriate.

6.2 HEIGHT ADJUSTMENT

6.2.1 An adjustment range of 7 inches is recommended for seated operations and 14 inches for standing positions.

6.2.2 Additional adjustment may be necessary to accommodate height variation in eyepieces of optical instruments to be used.

6.2.3 Height adjustment control should be accessible from the viewing position. The interpreter should not have to support the table during the adjustment operation.

COMPLIANCE			REMARKS
YES	NO	NA	
x			OK, standing and seated eye height measurement taken
x			OK, except all X & Y not reached with test configuration, but OK for Advanced Rhomboid Mod II attachment
		x	Microscope not evaluated
		x	
	x		None called for.
x			None
	x		All except height adjust switch when seated
x			OK

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